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BENCHMARKING OF NON-LINEAR WAKE INTERACTION OF EDDY VISCOSITY MODEL

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Abstract. *Modelling of wake losses is an important part of the production estimation for wind farms. The eddy viscosity model is widely adapted by industry for wind farm wake calculations and energy output predictions¹. Their practical implementations for linear wind resource grid generation tools and their ability to provide better accuracy in non-linear terms and turbulence terms^{1,2,3,4} created easy market penetration. As a result, the eddy viscosity wake models and their variants have found wide spread application in commercial wind farm design softwares.*

Compared to algebraic wake models, eddy viscosity model has intermediate complexity in physics. The referred model can be derived by simplification of Reynolds Averaged Navier-Stokes equations. This derivation reduces the complexity of the model compared to full CFD models⁵. The eddy viscosity model is derived by employing velocity deficit field using the thin shear layer approximation in axi-symmetric coordinates.

The eddy viscosity model's wake comparison has been limited to either CFD results comparison or to wind tunnel tests to this day^{2,14}. By introduction of more advanced spatial measurements techniques such as Lidar, it is now possible to have more detailed field comparison and validation to actual wind turbine measurements recently¹.

In this work, eddy-viscosity will be benchmarked to non-linear models such as actuator disc model in two turbine settings and to recently available Lidar data¹. This gives us further insight into the application envelope of the eddy viscosity model. The impact of different parameters on velocity deficit and turbulence approaches will be investigated. Power deficit as a function of ambient turbulence intensity will be validated. The impact of central speed deficit created by shadowing will be implemented to initial profile¹.

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